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DYNAMICS OF PLAYA LAKES IN THE TEXAS HIGH PLAINS

C.C. Reeves, Jr.
Remote Sensing Laboratory
Department of Geosciences
Texas Tech University
Lubbock, Texas 79409

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PREFACE

The purpose of this project is to correlate ERTS-1 satellite imagery signatures with the water balance ecosystem and geology of select playa lake basins in West Texas. Work has concentrated at the large Double Lakes test site in Lynn County, Texas, although ground-truth of three other small playas was determined.

The principal work during the report period consisted of monitoring the weather instruments, the measurement of water levels and water depths, examination of MSS imagery, and measurement of water and mud areas by use of ESIAC (Electronic Satellite Image Analysis Console) at Stanford Research Center, Menlo Park, California. A cost/benefit analysis, comparing the use of ERTS-1 data to more conventionally secured data, revealed that use of ERTS-1 data for such a survey results in a cost reduction from $2.00 to $0.03/square mile.

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INTRODUCTION

The purpose of this report is to describe work performed on the ERTS-1 Double Lakes study site, Lynn County, Texas, under NASA contract NAS 5-21720, proposal number 342-C, during the six-month period of April-September, 1973.

Ground-truth studies have been concluded at the test site, a synopsis of the work having been presented in partial fulfillment of requirements for the Bachelor of Science degree, in Geology (at Texas Tech University) by Mr. J.W. Buchanan. However, a core of the Double Lakes test site has not, as yet, been secured because of water and the muddy surface of the lake. During the year's observation, the Double Lakes test playa went from a flooded condition (July, 1972) to a dry surface (early July, 1973) to a flooded condition (late July, 1973). Film loops, based on time-lapse photography, are being constructed for display of not only the water fluctuations at the test playa, but of the water content of thousands of playas in the surrounding area.

ERTS-1 DATA

As of September 30, 1973, the ERTS-1 satellite made 23 passes over the test area. Imagery from 11 of these passes is known to be usable, 10 passes were lost to cloud cover,

and the disposition of the 2 passes in August has not as yet been determined.

All MSS bands, in 9 x 9 positive transparencies, and 70 mm in positives and negatives, are being received. CCT is also being received.

Receipt of data for this project terminates with the 4 October pass; however, receipt of data on a reduced scale has been requested for the following year to allow study and correlation of water quality at the test site with satellite imagery. No NASA funds have been requested for this study.

WORK PERFORMED

During the report period (April-September, 1973), the following work (directly or indirectly related to the project) was performed:

1) the talk "ERTS-1 Imagery For Water Inventory, Southern High Plains, Texas and New Mexico" was presented to the Americal Water Resources Symposium on Remote Sensing, June 11-14, Burlington, Ontario, Canada.

2) the research problem "Playa Lake Basin Alignments on the Southern High Plains" was initiated by Mr. J. Goebel. This is statistical analysis of the peculiar distribution of playa lake basins in several select areas of the Southern High Plains as revealed by ERTS-1 MSS imagery.

3) rock-bit drilling at the T-Bar test site revealed that the caliche surface mapped beneath the lake basin from power auger drilling is the Pleistocene Sangamonian caliche and not the Pliocene Ogallala caliche as originally suspected. The rock-bit holes intersect the Pliocene caliche on the east and west sides of the playa but indicate that the horizon is absent beneath the playa.

4) the talk "Remote Sensing of the Lubbock Area" was presented to the Lubbock Geological Society on September 18, 1973. ERTS-1 imagery of the area and uses thereof were presented to the public.

5) the period September 20-25 was spent at Stanford Research Institute, Menlo Park, California. All available coverage, of the 9 x 9 positive transparency type, was utilized on the ESIAC (Electronic Satellite Image Analysis Console) for time-lapse studies of the water fluctuations in the test site. Stanford Research personnel are now preparing film loops of this data.

6) the geology of the Double Lakes test site was presented during August as a graduate thesis in partial fulfillment for the Masters degree in geology at Texas Tech University by Mr. John W. Buchanan.

7) a cost/benefit analysis comparing use of ERTS-1 MSS and CCT imagery to conventional methods (aerial photographs, ground survey) for a survey of water resources in West Texas was also completed during the report period. An abstract of this study was submitted for presentation of the subject to the American Geophysical Union Symposia on "Evaluation of Water Resources From Satellite Observations", December 10-14, San Francisco.

8) water areas and mud areas for all available passes were also measured on the Stanford Research Institute ESIAC by using Band 5, Band 7, and false color renditions of the 9 x 9 positive transparencies.

9) the computer program written for use of the CCT's has not operated satisfactorily. Printouts of single MSS bands can be extracted but composites are still unavailable. LARS (Purdue University), however, is supplying the project with printouts of the Lynn County area covering the test site.

NEXT 6 MONTHS PROGRAM

Work to be performed during the next report period will consist of:

1) measuring film density of the water and mud areas of the test site,

2) correlation of film densities to various parameters such as water depth,
3) construction of 16 mm film loops (by Stanford Research Institute,
4) completion of correlation of weather data with water fluctuations at test site (comparisons with area and depth),
5) removal of weather stations at Double Lakes and T-Bar,
6) correlation of MSS and CCT data for test site,
7) assembling of data for inclusion in final report.

NTIS SUMMARY

Discipline 4 - Water Resources

Subdiscipline - Limnology

The purpose of this project was to correlate ERTS-1 satellite imagery signatures with the water balance ecosystem and geology of select playa lake basins in West Texas. Work has concentrated at the large Double Lakes test site in Lynn County, Texas.

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